Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application.

Listing of claims:

1-31. (Cancelled)

32. (Original) A method for entangling a quantum state of a first qubit with a quantum state of a second qubit, the method comprising:

tuning a resonant control system, which is capacitively or inductively coupled to said first qubit and said second qubit, to a first frequency for a first period of time, wherein said first frequency corresponds to an energy differential between a first potential energy level and a second potential energy level of said first qubit; and

adjusting said resonant control system to a second frequency for a second period of time, wherein said second frequency corresponds to an energy differential between a first potential energy level and a second potential energy level of said second qubit, thereby entangling the quantum state of the first qubit with the quantum state of the second qubit.

33. (Original) The method of claim 32, wherein said resonant control system is an anharmonic resonator.

34. (Original) The method of claim 32, wherein said resonant control system is superconducting.

35. (Original) The method of claim 32, wherein said resonant control system comprises a Josephson junction and a bias current source that is connected in series with the Josephson junction, and wherein said tuning and adjusting comprise altering a magnitude of said bias current source.

36. (Original) The method of claim 35, wherein said bias current source is $0.994*I_c$ or less during said tuning and adjusting, wherein I_c is the critical current of said Josephson junction.

37. (Original) The method of claim 35, wherein said bias current source is $0.990*I_c$ or less during said tuning and adjusting, wherein I_c is the critical current of said Josephson junction.

38. (Original) The method of claim 32, wherein said first period of time is one microsecond or less.

39. (Currently Amended) The method of claim 32, wherein said first period of time is one hundred ~~nanoseconds~~ nanoseconds or less.

40. (Original) The method of claim 32, wherein said first qubit is a different type of qubit than said second qubit.

41. (Original) The method of claim 32, wherein a length of said first period of time is a function of a length of said second period of time.

42. (Original) The method of claim 32, wherein said first period of time is long enough for said resonant control system to entangle with a quantum state of said first qubit.

43. (Original) The method of claim 32, wherein said second period of time is one microsecond or less.

44. (Currently Amended) The method of claim 32, wherein said second period of time is one hundred ~~nanoseconds~~ nanoseconds or less.

45. (Original) The method of claim 32, wherein a length of said second period of time is a function of a length of said first period of time.

46. (Original) The method of claim 32, wherein a length of said second period of time is a length of time that is sufficient for the resonant control system to entangle with the quantum state of said second qubit.

47. (Original) The method of claim 32, the method further comprising
applying a first quantum gate to said first qubit prior to said tuning; and
applying a second quantum gate to said first qubit after said tuning.

48. (Original) The method of claim 47 wherein said first quantum gate is a Hadamard gate and said second quantum gate is a Hadamard gate.

49. (Original) The method of claim 32, the method further comprising:
applying a first quantum gate to said second qubit prior to said adjusting; and
applying a second quantum gate to said second qubit after said adjusting.

50. (Original) The method of claim 49 wherein said first quantum gate is a Hadamard gate and said second quantum gate is a Hadamard gate.

51. (Original) The method of claim 32, wherein said first qubit, said second qubit, or both said first qubit and second qubit are described by a native interaction Hamiltonian that includes an off diagonal interaction term.

52. (Original) The method of claim 51, wherein said first qubit, said second qubit, or both said first qubit and said second qubit are a superconducting charge qubit.

53. (Original) The method of claim 32, wherein said first qubit, said second qubit, or both said first qubit and said second qubit are described by a native interaction Hamiltonian that includes a diagonal interaction term.

54. (Original) The method of claim 53, wherein said first qubit, said second qubit, or both said first qubit and said second qubit is a charge qubit, a phase qubit, or a flux qubit.

55. (Original) A method for entangling a first qubit in a first qubit group with a second qubit in a second qubit group, the method comprising:

(A) coupling, for a first period of time, said first qubit with a first resonant control system by biasing said first resonant control system to a first frequency, said

first frequency determined by an energy differential between a first potential energy level and a second potential energy level of said first qubit;

(B) coupling, for a second period of time, said first resonant control system to a pivot qubit by biasing said resonant control system to a second frequency, said second frequency determined by an energy differential between a first potential energy level and a second potential energy level of said pivot qubit;

(C) isolating said pivot qubit from said first qubit group and said first resonant control system;

(D) coupling, for a third period of time, a second resonant control system with said pivot qubit by biasing said second resonant control system to a third frequency, said third frequency determined by said energy differential between said first potential energy level and said second potential energy level of said pivot qubit; wherein said second resonant control system is capacitively or inductively coupled to said second qubit in said second qubit group;

(E) isolating said second qubit group and said second resonant control system from said pivot qubit; and

(F) coupling, for a fourth period of time, said second resonant control system with said second qubit by biasing said second resonant control system to a fourth frequency, said fourth frequency determined by a first potential energy level and a second potential energy level of said second qubit.

56. (Original) The method of claim 55, wherein said first resonant control system is an anharmonic resonator and said second resonant control system is an anharmonic resonator.

57. (Original) The method of claim 55, wherein said first resonant control system is superconducting and said second resonant control system is superconducting.

58. (Original) The method of claim 55, wherein said first resonant control system includes a Josephson junction and a bias current source, wherein the bias current source is connected in series with the Josephson junction, and wherein said biasing in said coupling (A) and said coupling (B) comprises adjusting said bias current source.

59. (Original) The method of claim 55, wherein said bias current source is $0.994*I_c$ or less during coupling (A) and said coupling (B), and wherein I_c is the critical current of said Josephson junction.

60. (Original) The method of claim 55, wherein said bias current source is $0.990*I_c$ or less during said coupling (A) and said coupling (B), and wherein I_c is the critical current of said Josephson junction.

61. (Original) The method of claim 55, wherein said second resonant control system comprises a Josephson junction and a bias current source, wherein said bias current source is connected in series with the Josephson junction, and wherein said biasing in said coupling (D) and said coupling (F) comprises adjusting said bias current source.

62. (Original) The method of claim 61, wherein said bias current source is $0.994*I_c$ or less during said coupling (D) and said coupling (F), and wherein I_c is the critical current of said Josephson junction.

63. (Original) The method of claim 61, wherein said bias current source is $0.990*I_c$ or less during said coupling (D) and said coupling (F), and wherein I_c is the critical current of said Josephson junction.

64. (Original) The method of claim 55, wherein each of said first period of time, said second period of time, said third period of time, and said fourth period of time is one microsecond or less.

65. (Currently Amended) The method of claim 55, wherein each of said first period of time, said second period of time, said third period of time, and said fourth period of time is one hundred ~~nanoseconds~~ nanoseconds or less.

66. (Original) The method of claim 55, wherein said first qubit is a different type of qubit than said second qubit.

67. (Original) The method of claim 55, wherein coupling (B) comprises

(i) closing a first switch between said first resonant control system and said pivot qubit for a duration greater than said second period of time; and

(ii) opening said first switch.

68. (Original) The method of claim 55, the method further comprising;

(G) coupling said first resonant control system to said first qubit for a period of time equivalent to said first period of time, wherein said coupling is performed after said second period of time has elapsed.

69. (Original) The method of claim 55, the method further comprising:

(G) coupling said second resonant control circuit to said first pivot qubit for a period of time that is equivalent to said third period of time, wherein said coupling is performed after said fourth period of time has elapsed.

70. (Original) The method of claim 55, the method further comprising:

(G) applying a first quantum gate to said first qubit prior to said coupling (A); and

(H) applying a second quantum gate to said first qubit after said coupling (A).

71. (Original) The method of claim 70, wherein said first quantum gate is a Hadamard gate and said second quantum gate is a Hadamard gate.

72. (Original) The method of claim 55, the method further comprising:

(G) applying a first quantum gate to said second qubit prior to said coupling (F); and

(H) applying a second quantum gate to said second qubit after said coupling (F).

73. (Original) The method of claim 72 wherein said first quantum gate is a Hadamard gate and said second quantum gate is a Hadamard gate.

74. (Original) The method of claim 55, wherein said first qubit, said second qubit, or both said first qubit and second qubit are described by a native interaction Hamiltonian that includes an off diagonal interaction term.

75. (Original) The method of claim 74, wherein said first qubit, said second qubit, or both said first qubit and said second qubit are a superconducting charge qubit.

76. (Original) The method of claim 55, wherein said first qubit, said second qubit, or both said first qubit and said second qubit are described by a native interaction Hamiltonian that includes a diagonal interaction term.

77. (Original) The method of claim 76, wherein said first qubit, said second qubit, or both said first qubit and said second qubit is a charge qubit, a phase qubit, or a flux qubit.

78-122. (Cancelled)